NOMENCLATURE

10 – Compressed Soil Block
15 – Trailer
16 – Jack
17 – Soil Hopper
19 – Hopper Support Frame
21 – Axle Assembly
22 – Axle Assembly
23 – Ground
25 – Anterior Hydraulic Actuator
26 – Posterior Hydraulic Actuator
27 – Multiple Function Case
28 – Multiple Function Case
29 – Hydraulic Tank
31 – Actuator Rod
32 – Actuator Rod
33 – Case Support Frame
35 – Roller Conveyor
36 – Connection Point
37 – Connection Point
38 – Lower Cover
39 – High-Frequency Vibration Apparatus
40 – Lower Cover
41 – Upper Cover
42 – Upper Cover
43 – Brace
44 – Connecting Panel
45 – Cover Panel
46 – Anterior Compression Head
47 – Posterior Compression Head
48 – Soil Intake Aperture
49 – Soil Receiving Area
51 – Soil
57 – Compression Head Wear Plate
59 – Compression Head Wear Plate
60 – Compression Case
61 – Compression Case Wear Plate
63 – Compression Case Wear Plate
65 – Compression Case Wear Plate
67 – Compression Case Wear Plate
69 – Compression Head Wear Plate
71 – Compression Head Wear Plate
73 – Compression Head Frame
75 – Rear Compression Head Plate
77 – Compression Head Frame

79 – Rear Compression Head Plate
80 – Block Discharge
81 – Positioning Control Apparatus
83 – Position Switch Actuator
84 – Position Switch Actuator
85 – Position Switch Actuator
87 – Position Switch Actuator
89 – Position Switch Actuator
90 – Proximity Switch
91 – Proximity Switch
92 – Proximity Switch
93 – Proximity Switch
94 – Proximity Switch
95 – Programmable Logic Control (PLC)
97 – Control Panel
99 – Hydraulic Pump
101 – Electrical Motor
103 – Adjustable Pressure Switch
104 – Adjustable Pressure Switch
105 – Anterior Valve Assembly
106 – Posterior Valve Assembly
107 – Solenoid
108 – Hydraulic Circuit
109 – Solenoid
110 – Hydraulic Line
112 – Hydraulic Line
114 – Hydraulic Line
116 – Hydraulic Line
118 – Hydraulic Line
120 – Hydraulic Line
121 – Hydraulic Line
123 – Hydraulic Line
125 – Hydraulic Line
128 – Hydraulic Line
130 – Hydraulic Line
132 – Hydraulic Line
134 – Hydraulic Line
136 – Input Line
138 – Input Line
140 – Input Line
142 – Input Line
144 – Input Line
146 – Input Line
147 – Input Line
148 – Output Line
150 – Output Line

152 – Output Line
154 – Output Line
156 – Output Line
158 – Output Line
160 – Output Line
162 – Output Line

Field of the invention

This invention relates to a linear self-enclosed apparatus for compressing freshly dug soil into compressed blocks suitable for the creation of a structure.

Background of the Invention

The formation of building blocks from soil and clay is a well-known process utilized throughout the world. Throughout the years various applications designed to automate this process have been produced. Previously designed apparatus, however, have involved complex mechanical procedures. A need exists for a design and process in which building blocks of different sizes and thickness can be formed simultaneously. An additional need exists for a design that allows for two or more systems to be joined and operated simultaneously or independently, while maintaining an easy access to replaceable components.

Examples of previous known form of presses similar to the present invention are disclosed in U.S. Pat. Nos. 4,640,671; 6,224,359.

Summary of the Invention

The main objective of this invention is to provide a new and improved **linear building block forming apparatus** which is self-contained and capable of receiving a quantity of soil, forming building blocks of adjustable dimensions uniformly, and ejecting said blocks within a single multiple function case.

It is also an object of the invention to provide a new and improved **linear building block forming process** that is linear and contained within a multiple purpose case.

It is also an object of the invention to provide a new and improved **linear building block forming process** in which opposing compression heads are moved toward and away from one another with the purpose of receiving an adjustable quantity of soil, moving said soil, compressing said soil into a block and ejecting a compressed soil block.

It is also an object of the invention to provide a new and improved **linear building block forming process** in which opposing compression heads are moved toward and away from one another by any mechanical means.

It is therefore an object of the invention to provide a new and improved **linear building block forming apparatus** that may be mounted on a trailer chassis and may be towed to the site of construction.

It is another object of the invention to provide a new and improved **linear building block forming apparatus** that will create building blocks of different plan sizes utilizing a

heavy textured clay, preferably without any addition of moisture or binder material with minimal skill or effort from the operator.

It is the objective of the invention to provide a new and improved **linear building bl ck forming apparatus** that will compress the soil under high pressure to produce a building block so dense when ejected from the multiple function case that it will be instantly ready for use and need not be cured before use.

It is a further object of the invention to provide a new and improved **linear building block forming apparatus** that is modular in nature to allow for the addition of one or more multiple function cases, which may be controlled simultaneously or independently.

It is therefore also an object of the invention to provide a new and improved **linear building block forming apparatus** that is modular in nature to allow for higher production yields or to allow for production of blocks of different dimensions simultaneously or independently.

It is also an objective of the invention to provide a new and improved **linear building block forming apparatus** that produces uniform blocks dimensionally of adjustable sizes, which can be used to construct a structure by progressively dampening the upper course of the structure with water or light mud slurry, and placing the next course directly on top of this course

It is still another object of the invention to provide a new and improved **linear building block forming apparatus** that is of durable construction.

It is also another object of the invention to provide a new and improved **linear building block forming apparatus** that requires low maintenance and is easily serviced.

It is yet another object of the invention to provide a new and improved **linear building block forming apparatus** that can be assembled and operated with minimal skill and attention.

It is still a further object of this invention to provide a new and improved **linear building block forming apparatus** that loads soil into the soil receiving area of the multiple function case efficiently and in a more compacted state by the use of a high-frequency vibration apparatus mounted directly to the soil receiving hopper.

These and other advantages, features and objects of the invention will become more apparent from the following description taken in connection with the illustrative embodiment in the accompanying drawings.

Brief Description of the Drawings

FIG. 1 is a side lateral view of a four wheel mounted trailer form of the instant invention;

FIG. 2 is a top view of the invention mounted atop a four wheeled trailer chassis in which the soil hopper and a pair of hydraulic actuators have been fragmented to illustrate the multiple function case;

FIG. 3 is a partially fragmented top view of the multiple function case in which the compression heads and hydraulic actuators are more clearly illustrated;

FIG. 4 is a partially fragmented rear view of the invention mounted atop a four-wheeled trailer chassis;

FIG. 5 is a rear lateral view of the invention showing a pair of multiple function cases, in which one contains a positioning control apparatus, which have been joined together about their corresponding connecting panels;

FIG. 6 is a sectional view taken about line 6 – 6 in FIG. 3 showing the locations and positions of the soil hopper, adjustable compression heads and their components, multiple function case and its components, and loose soil prior to compaction;

FIG. 7 is a partially fragmented side lateral view of the multiple function case showing the movement and positions of the compression heads, multiple function case and its components, compressed soil block and loose soil at compaction;

FIG. 8 is a partially fragmented side lateral view of the multiple function case showing the movement and positions of the compression heads, multiple function case and its components, compressed soil block and loose soil at the moment the compressed soil block is ejected from the multiple function case;

FIG. 9 is a fragmentary diagrammatic view illustrating the manner in which the hydraulic actuators may be controlled for the purpose of achieving desired compression between compression heads, and

FIG. 10 is a rear lateral view of the invention showing a plurality of multiple function cases, in which one contains a positioning control apparatus, which have been joined together about their corresponding connecting panels.

Descripti n of the Preferred Embodiment

Referring now more specifically to the drawings, the numeral 15 generally designates a trailer frame which may be towed behind a towing vehicle (not shown) and which includes a pair of wheeled axle assemblies 21 and 22 on its rear end as well as a jack structure 16. The jack structure 16 may be utilized in order to stationary support the trailer frame 15 from the ground 23.

The trailer frame 15 supports a case support frame 33, a hydraulic tank 29, a programmable logic control (PLC) unit 95, a control panel 97, a hydraulic pump 99, an electrical motor 101, a pair of roller conveyors 35, as well as a hopper support frame 19.

As seen in FIGS. 1 and 4, the hopper support frame 19 contains the soil hopper 17 positioned above the pair of multiple function cases 27 and 28, in a stationary position. Said soil hopper 17 is supported by a pair of braces 43 about its discharge area.

The case support frame 33 supports a pair of multiple function cases 27 and 28, each with a pair of hydraulic actuators 25 attachable at a point generally referred to by the numeral 37 as seen in FIGS. 2 and 4.

The multiple function cases 27 and 28 are representative of a possible combination whereby both cases will function in unison to create compressed soil blocks uniform in size, thickness, and density (See FIG. 3). As illustrated in FIG. 5, the multiple function cases 27 and 28 are symmetrical about their connecting panels 44.

As is illustrated in FIGS. 3, 5 and 6, the multiple function cases, 27 and 28, are composed of compression heads, generally designated by numerals 46 and 47, side cover panels 45, connecting panels 44, upper covers 41 and 42 and lower covers 38 and 40. As can be seen in the previously mentioned FIGS., the upper covers 41 and 42, along with bottom covers 38 and 40 and panels 44 and 45 are joined to form an enclosed area. Said enclosed area contains two apertures designated by numerals 48 and 80. It is within said enclosed area that a compression case area, generally designated by numeral 60 is formed. Within said compression case area 60 compression case wear plates 61, 63, 65 and 67 are mounted securely. Said wear plates are to be constructed of a hardened steel alloy capable of withstanding high abrasion.

As illustrated in FIGS. 3 and 6, the compression heads 46 and 47 are comprised of compression head frames 73 and 77. Compression head wear plates 57, 59, 69 and 71 are securely mounted to said compression head frames as illustrated. Said wear plates are to be constructed of a hardened steel alloy capable of withstanding high abrasion.

The compression heads 46 and 47 are introduced within the compression case area 60 at opposite ends of said compression case and are secured by rear compression head plates 75 and 79 as seen in FIG. 6. As can be seen in FIG. 3, the rear compression head plates 75 and 79 are then attached to the hydraulic actuators 25 and 26 by means of actuator

rods 31 and 32 at connection points generally designated by numerals 36 and 37, respectively.

In reference to FIGS. 1, 3 and 6, as soil 51 is loaded into the soil hopper 17 by manual or mechanical means. At commencement of the "first stage" of operation, a high-frequency vibration apparatus 39 increases the force by which loose soil 51 passes downwardly through said soil hopper 17 and into an adjustable soil receiving area 49. The downward force of the soil, aided by gravity and said vibration apparatus will uniformly fill and compact, the soil in said receiving area. At a preset interval of time the first stage of operation terminates as the PLC system 95 will disengage the high-frequency vibration apparatus 39.

As can be seen in FIG. 3, during the initial process, anterior hydraulic actuators 25 will be in fully retracted positions, while posterior hydraulic actuators 26 will be fully extended. Said actuators are coupled to anterior 46 and posterior 47 compression heads at connection points generally designated by numeral 37. The positions of said actuators and respectively, said compression heads hereby aid in forming a soil receiving area 49, which is adjustable in accordance to the positions of said compression heads within the compression case area 60. In reference to FIG. 7, as the "second stage" of operation begins, both anterior and posterior hydraulic actuators (not shown) engage the anterior compression head 46 and posterior compression head 47. Said compression heads travel to preset destinations as shown in FIG. 7. As is illustrated in FIG. 7, the posterior compression head 47 will stop and remain stationary, as the anterior compression head 46 remains engaged. Thus, the "third stage" of operation begins. As the anterior compression head 46 travels within the compression case area 60 towards the posterior compression head 47 the soil 51 between said compression heads will become compacted further, until a block of compacted soil 10 is formed between said heads.

In reference to FIGS. 7 and 9, the compression of the soil 51 between said compression heads will create a rise in hydraulic pressure in hydraulic line 118. When an initial preset pressure is reached in said hydraulic line, an adjustable pressure switch 103 will engage, and the PLC unit 95 will actively engage valve assembly 106 to increase pressure in hydraulic line 112. Hence, the posterior hydraulic actuator (not shown) will be engaged along with the posterior compression head 47 to travel towards the anterior compression head 46. The dual compression of said compressed soil block will continue to elevate hydraulic pressure within hydraulic lines 112 and 118. Upon reaching an optimal preset compression pressure in said hydraulic lines the adjustable pressure switch 104 will engage, and the PLC unit 95 will actively engage valve assembly 106 to disengage pressure in hydraulic line 112, thus diverting the hydraulic pressure to hydraulic line 120.

As illustrated on FIG. 8, whereas a compressed soil block 10 has been successfully formed within the compression case area 60 by utilizing opposing compression heads 46 and 47, the "fourth stage" of operation commences. As the posterior hydraulic actuator (not shown) retracts, the posterior compression head 47 is withdrawn to the position illustrated in FIG. 8. As the anterior hydraulic actuator (not shown) continues through the compression case area 60, the anterior compression head forces the compressed soil

block 10 into the block discharge area 80. Subsequent to the completion of a full operation, the discharged compressed soil block 10 will exit the invention. Fig. 8 generally illustrates the completion of the "fourth stage" of operation, and more specifically, the general locations of compression heads 46 and 47. Whereas the "fourth stage" is completed, the hydraulic actuators 25 and 26 will return to their original 'base' positions. The PLC unit 95 will then re-engage the high-frequency vibrating apparatus 39.

With attention now invited more specifically to FIG. 9, it may be seen that the hydraulic actuators 25 and 26 are serially connected within a hydraulic circuit 108 including a pump 99 for pumping hydraulic fluid from a reservoir 29, to the actuators 25 and 26 and then back to the reservoir 29. The hydraulic circuit 108 includes valve assemblies 105 and 106 serially connected therein and the valve assemblies 105 and 106 are under the control of a pair of solenoids 107 and 109 actuated by output conductors 148, 150, 152, 154, 156, 158, 160 and 162, from a PLC unit 95. A plurality of proximity switches 90, 91, 92, 93 and 94 are stationary and mounted relative to the compression heads 46 and 47 and corresponding proximity switch actuators 83, 84, 85, 87 and 89 are adjustably mounted on the positioning control apparatus 81. In addition, adjustable pressure switches 103 and 104 are communicated with circuits 105 and 106 on the side thereof pressurized to extend the actuator rods 31 and 32. The proximity switches 90, 91, 92, 93 and 94 and pressure switches 103 and 104 are supplied current from a supply (not shown) and are connected to a PLC unit 95. The pressure switches 103 and 104 including their own output lines 146 and 147, respectively, comprising an input to PLC unit 95. Similarly, the proximity switches 90, 91, 92, 93 and 94 including their own output lines 140, 142, 144, 136 and 138, respectively, comprising an input to PLC unit 95.

The valves 105 and 106, actuated by the PLC unit 95 through output lines 148, 150, 152, 154, 156, 158, 160 and 162, are operable to connect the output line 110 from the pump 99 to either the input lines 112, 114, 116 and 118 for extending the actuator rods 31 and 32 or lines 120, 121, 123 and 125 for retracting the actuator rods 31 and 32. Of course, if the output line 110 from the pump 99 is communicated with lines 112, 114, 118 and 120, lines 120, 121, 123 and 125 are communicated with the return lines 128, 130, 132 and 134 to the reservoir 29. On the other hand, if the line 110 is communicated with lines 120, 121, 123 and 125, lines 112, 114, 118 and 120 are communicated with the 128, 130, 132 and 134 to the reservoir 29.

By removing the individual compression heads 46 and 47 from the compression case area 60, individual working components of the apparatus may be readily renewed, if desired. Further, by utilizing variations of the compression case area 60 and compression heads 46 and 47, the size and shape of the compressed soil blocks 10 to be formed may be varied.

Mounted on the frame are two support frames, 19 and 33, which support the hopper 17 and multiple function cases generally designated by the numeral 27.

As soon as the compressed soil block 10 is discharged onto the conveyor 35, it is ready to use in the building process. With the use of the apparatus as depicted, the operator only

has two tasks: first, to place soil into the hopper 17, and second, to assemble the compressed soil blocks 10 into a structure.

The blocks 10 should be laid flat. After a course of blocks 10 has been laid, the upper flat surfaces of the blocks may be sprayed with water or mud slurry, so as to be slightly moistened when the next course of blocks is placed on it.

The embodiment of the invention as depicted can be summarized as follows. A plurality of linear multiple function cases. 27 and 28, each has a soil receiving area 49. The soil receiving area 49 is open vertically to the sky. The compression heads, 46 and 47, are positioned as to provide the lateral walls within the soil receiving area 49. The hopper 17 containing pre-granulated soil is mounted stationary above multiple function cases 27 and 28. Mounted along the frame of the hopper is a vibration apparatus 39 which, when in operation along with gravity, feeds granulated soil into the soil receiving area 49 and in doing so, maximizing the soil density. This is most important for the production of high quality uniform building blocks.

When the hopper has filled the soil receiving area 49 the hydraulic actuators are activated, and the compression heads, 46 and 47, move the soil within the multiple function case to its intended second stage location. It is at this second stage that the posterior compression head 47 remains in a fixed position momentarily while the anterior compression head 46 remains engaged and begins to lightly compact the soil 51.

The soil compression process is completed during the third stage whereas the posterior compression head 47 is re-engaged to travel in the direction of the anterior compression head 46. Simultaneously, the anterior compression head 46, continues to press the soil in its travel towards the posterior compression head 47. Hence, with the combined forces and relative applied pressure to the soil between said compression heads, the lightly compacted soil is compressed into a high-density compressed soil block 10.

During the following fourth stage, both compression heads, 46 and 47, are moved within the multiple function cases, 27 and 28 toward the block discharge area 80, at which the finished compressed soil block 10 falls away free of the trailer 15 and onto a conveyor system 35 for use.

The apparatus mounted on a heavy frame suitable to sustain the hydraulic forces of the hydraulic actuators 25 and 26 and compression heads, 46 and 47.

While there is shown and described herein certain specific structure embodiments in the invention, it may be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.